## Nanostructured surfaces

# Surface engineering using *in situ* synthesis of hybrid polymeric materials

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Purposeful design of new nanostructured materials and functional coatings on their basis for photovoltaic and fuel cells, electrochemical and optical sensors, semiconducting and optoelectronic devices requires determination of the main regularities of influence of geometrical, morphological and structural parameters on their physico-chemical and functional properties.

A promising research area is the development of methods of obtaining hybrid materials and nanocomposites which are based on the deposition of thin films of organic polymers on a substrate with preformed arrays of inorganic nanostructures or introduction of the nanoscale objects into the polymeric matrix. Of particular interest are thin films of conducting polymers with incorporated palladium nanoparticles or bimetallic core-shell objects. At the same time, for obtaining of such materials the precise control of the polymers conductivity and the coating morphology is required for improving the electrocatalytic activity.

In this paper the method for obtaining the polymer coatings due to oxidizing polymerization of aniline derivatives involving $Fe^{3+}$ cations in stationary conditions directly on the substrate was proposed. It was found that the introduction of $Fe_2(SO_4)_3$ and KI leads to the significantly increased coating formation rate, which is caused by the catalytic effect of $Fe^{3+}$ ions and the functioning of the $I^-/I_2$ redox system. The coatings characterization was carried out using SEM, AFM and FTIR methods. According to the performed simulations, obtained materials may show better stability and improved electrocatalytic performance.

It should also be noted that the presence of $I^-$ ions has a significant influence on the PDPA conductivity due to electron delocalization during the redistribution of electron density, which allows to control the polymerization rate as well as the electrical conductivity of the obtained coatings. The proposed method of obtaining coatings provides rich capabilities to control the deposition process for fine tuning the characteristics of polymer films to form coatings for various applications.